AMPEX

December 23, 1975
Serial No. TMS-2/070

STAT

Copy to
John Sling...
OSCS

OSCS

Mr. [redacted]
Contracting Officer
Post Office Box 1073
Main Post Office
Washington, D.C. 20013

STAT Subject : Contracts [redacted] TMS-2 Mass Storage System

Reference: Telecon of 12-23-75, W. Slingland to [redacted] STAT

Gentlemen:

Confirming the referenced telephone conversation this morning, this is to advise that Ampex is in process of preparing a formal response to your 12-4-75 cable to V. Ragosine.

The response provided by Ampex during the 12-18-75 meeting should, therefore, not be considered as Ampex formal position on the issues addressed.

As a result of the meeting, Ampex has a different view of the concerns raised by the Agency in connection with the TMS-2 Mass Storage System and will take this better understanding into account.

Our formal position and response will be reviewed with Ampex Management early during the week of 1-5-76 and a response addressed to the Contracting Officer will be submitted no later than 1-9-76.

Very truly yours,
AMPEX CORPORATION

William J. Cassell
Manager, System Contracts.

WJC/fp

c.c. Mr. H.E. Fitzwater
STAT [redacted]

Terabit Memory Systems Department
Ampex Corporation • 1020 Kifer Road • Sunnyvale, California 94086
TWX 910 338 0920 TELEX 348464

23 December 1975

MEMORANDUM FOR THE RECORD

On 23 December 1975, I returned a call to Mr. William Slingland of Ampex. He asked me if the operator had made a conference call to include Mr. Cassell. I stated that I was merely returning his call.

Mr. Slingland then stated that the information they had presented at the 18 December 1975 meeting did not constitute their official response to the Government's message of 4 December 1975 and asked that we not proceed on the basis of their position at that meeting.

Mr. Slingland said that Ampex was going to have an internal management meeting on 5 January 1976. After this meeting, Ampex would provide their official response to the Government's message.

I stated that I understood their position but that we were proceeding with our own review of the program. I told Mr. Slingland that if they were going to provide a formal response in lieu of their presentation of the 18th of December, we would need a "not later than" date for the submission and suggested that he send us a message to that effect.

STAT

[redacted]

Chief, SC&PS

[illegible]-2 MASS STORAGE SYSTEM

REDWOOD CITY [illegible]SAT BACKGROUND

- "JOINT DISCOVERY" APPROACH BELIEVED BENEFICIAL IN UNDERSTANDING OVERALL SOFTWARE DEVELOPMENT PROGRESS.

- AS A RESULT, AMPEX MODIFIED OWN PREPARATION GROUND RULES TO MEET NOVEMBER 19 SCHEDULE.

- EXTENSIVE TEST DEPENDENCY REQUIRED "PERFECT" HARDWARE OPERATION OR "RECOVERY/WARM START" CAPABILITIES NOT ANTICIPATED IN RELEASE 1.

- INORDINATE NUMBER OF ASCEND/DESCEND FAILURES OCCURRED FIRST FOUR(4) DAYS OF TESTING.

- DRAMATIC IMPROVEMENT IN SYSTEM RELIABILITY AFTER INSTALLATION OF READ-VERIFY AND DATA CHANNEL ADJUSTMENT.

12-16-75

IS-2 MASS STORAGE SYSTEM

REDWOOD CITY PSAT SUMMARY

- Twenty(20) Test Sessions During Seven(7) Day Period, November 19-25, 1975.

- Approximately Thirty-One(31) Hours Of Testing, Including Eight(8) Hours Stand Alone.

- Descend Data - Disk To Tape

Total Attempts	231
Successful	205
Failed Before Corrective Action	20
Failed After Corrective Action (All Recovery Related)	6

- Ascend Data - Tape To Disk

Total Attempts	126
Successful	116
Failed Before Corrective Action	10
Failed After Corrective Action	0

- Conclusion - No Files Lost After Corrective Action Implemented.

12-16-75

TMS-2 MASS STORAGE SYSTEM

RWC PSAT OVERVIEW

FAILURE - CORRECTIVE ACTION SUMMARY

- SIXTY-FOUR(64) OCCURRENCES IDENTIFIED

  FORTY-SIX(46) - HARDWARE RELATED

  EIGHTEEN(18) - SOFTWARE RELATED

- ALL PROBLEMS DIAGNOSED AND,

  1. FIXES IMPLEMENTED FOR ALL RELEASE 1 FEATURES EXCEPT SET SEGMENT SIZE < 10 SCHEDULED FOR FINAL.

  2. REMAINING ITEMS ALL RELATED TO RECOVERY AND SCHEDULED FOR FINAL RELEASE.

12-16-75

S-2 MASS STORAGE SYSTEM

RWC PSAT SUMMARY

HARDWARE RELATED FAILURES - 46

- o TWENTY-SIX(26) OCCURRENCES
  DESCENDING DATA FROM DISK TO TAPE
  - TWENTY(20) PRIOR TO INSTALLATION OF FIXES.
  - SIX(6) AFTER "READ VERIFY" SOFTWARE AND DATA CHANNEL ADJUSTMENT. ALL RELATED TO RECOVERY NOT SUPPORTED BY RELEASE 1.

- o TEN(10) OCCURRENCES
  ASCENDING DATA FROM TAPE TO DISK
  - NONE AFTER FIXES INSTALLED.

- o TWO(2) OCCURRENCES
  DA-11 DEC INTERFACE BETWEEN SCP & EDCP
  - REPLACED HARDWARE.
  - RANDOM FAILURE.

- o EIGHT(8) OCCURRENCES
  CHANNEL SIMULATOR/TRANSPORT DRIVER INTERRUPT HANDLING DESIGN ERROR CAUSED HARD SYSTEM ABORTS
  - CORRECTIVE ACTION IMPLEMENTED.

.3-2 MASS STORAGE SYSTEM

RWC PSAT SUMMARY

SOFTWARE RELATED FAILURES - 18

- o TWELVE(12) OCCURRENCES

  FUNCTIONAL DEFICIENCIES IN RELEASE 1 SOFTWARE

  - ELEVEN(11) CORRECTIVE ACTION IMPLEMENTED, INSTALLED, AND TESTED OK.
  - ONE(1) (SET SEGMENT TIME LIMIT 10) PARTIAL CAPABILITY IN PLACE BALANCE FOR FINAL RELEASE.

- o SIX(6) OCCURRENCES

  FINAL RELEASE RECOVERY IMPLICATIONS.

12-16-75

				COMMENTS
1	Ø	Ø	---	---
2	23	1	95%	(1) Reason
3	31	Ø	1ØØ%	---
4	3	3	Ø%	(3) Reason I
5	Ø	Ø	---	---
Software Modification				READ VERIFY INSTALLED
6	3	3	Ø%	(2) Reason II (1) Reason I
7	1Ø	3	77%	(3) Reason I
8	41	1Ø	8Ø%	(4) Reason I (6) Reason II
Hardware Modification				DATA CHANNEL ADJUSTED
9	15	2	88%	(2) Reason I
1Ø	Ø	Ø	---	---
11	23	Ø	1ØØ%	---
12	Ø	Ø	---	---
13	2Ø	1	95%	(1) Reason IV
14	21	1	95%	(1) Reason I
15	Ø	Ø	---	---
16	18	2	89%	(2) Reason III
17-2Ø	21	Ø	1ØØ%	---

ASCEND SUMMARY

SESSION	# ASCENDS	# FAILURES	% SUCCESSFUL	COMMENTS
1-2	Ø	Ø	---	---
3	2Ø	1	95%	(1) Reason II or V
4	6	2	67%	(2) Reason II or V
5	Ø	Ø	---	---
Software Modification				READ VERIFY INSTALLED
6-7	Ø	Ø	---	---
8	23	7	77%	(1) Reason VII (5) Reason V (1) Reason VI
Hardware Modification				DATA CHANNEL ADJUSTED
9-2Ø	77	Ø	1ØØ%	No file loss after Read Verify installed and Data Channel alignment modification made.

REASONS

(15) Reason I -Bad tracks existed at two locations on BSSØØ1. Handling of these tracks is a recovery function, not planned for PSAT. Specific tracks were: Cylinder 28, Track 8 & Cylinder 288, Track 5.

(11) Reason II -Data Channel Read electronics improperly set-up to handle drop-outs. Found prototype unit requires separate set-up procedure. Adjusted R11 on Assembly 6211540 to eliminate errors.

(2) Reason III -Overflow record which spanned cylinder boundary. Error recovery function not planned for PSAT.

(1) Reason IV -Demarkable block found. Recovered on retry at different tape location. Automatic demark not PSAT function.

(7) Reason V -Read Verify function required as part of each Descend operation. Installed for usage after Session #5.

(1) Reason VI -Data Channel wire found disconnected after PSAT at Pin 22, J2, of Assembly 621139. This file was recoverable after reconnecting this wire.

(1) Reason VII -Reserve failure. Recovery not supported for PSAT.

PSAT ASCEND & DESCEND SUMMARY

	DESCEND	ASCEND
Sessions 1-20:		
Attempted	231	126
Completed	205	116
Failed	26	10
Success Ratio	89%	92%
Sessions 9-20:		
Attempted	118	77
Completed	112	77
Failed	6	0
Success Ratio	95%	100%

CONCLUSIONS:

- No file loss on Ascend after Read Verify and Data Channel change implemented.
- All Descend failures are attributable to recovery functions not supported for PSAT.

TGW
12/17/75

OTHER HARDWARE FAILURES

SA11-B	Two failures attributed to malfunction of this device. Replaced first portion after Session #1, remainder after Session #4.
SA11/TDIF Interrupt Handling	Eight (8) failures attributed to inability of SA11 and TDIF hardware to properly handle simultaneous interrupts. Missing wire added to SA11. TDIF design modified. Solution implemented and fully tested.

TGW
12/17/75

TMS-2 MASS STORAGE SYSTEM

SUMMARY OF SOFTWARE ERRORS

Session #'s	Occurrences	Description	Fix Implemented
2	2	- Error messages & completion messages not printed on flush command.	Fixed during PSAT
4	1	• "Setup complete" message in error should have been "breakdown complete". Interpreter cancelled job.	Fixed during PSAT
4	1	- Segment time limit currently at 10 instead of 1. File transfer segmentation limit currently at 17 segments for descend-disallowing large files.	Final release (R1 limited)
4	1	◆ SRQ full - request queue filled with job stream $1803MBL - set up for Biggie 1,2,3, & 4. Messages prioritized during PSAT to drop low priority information only when full. Final system will have sufficient space.	Partial fix during PSAT
7	1	◆ Flush failure - nothing happened. Software timeout to TDP after lost interrupt. Error recovery will correct this.	Final release
9	1	◆ MSS aborted - incorrect MFD entries due to manual restart procedures. Error recovery will correct this.	Final release
10	1	◆ MSS sent incorrect message to host then hung looping. Manual restart procedure and incorrect MFD entries. Error recovery will correct this.	Final release

Key: ◆ Hard failure - caused system abort or required IPL to continue
• Incorrect operation - system did not function to specification
- Interpretation of operation - no files lost, jobs ran ok

... 2

P.2 - TMS-2 Summary of Software Errors

Session #'s	Occurrences	Description	Fix Implemented
13	1	• File conflicts. WM logic erroneously treated DISP on file required for 3 steps of a job.	Fixed during PSAT
13,16	3	• Priority conflicts - LIFO instead of FIFO within priority.	Fixed after PSAT
13	1	• Non-recognition of change in BSS configuration unless MSGØ91 received at IPL time.	Fixed after PSAT
17,18,19	3	• Deallocation did not stop - min/max logic not functioning correctly.	Fixed after P f
17	1	◆ Allocation lockout, space de-allocated on disk without MSS notification, wait loop for space. Error recovery will handle this.	Final release
20	1	◆ Display file abort - allocation lockout, op command had conflicting information on aborted. Error recovery will handle this.	Final release
	18		

Key: ◆ Hard failure - caused system abort or required IPL to continue (6)
• Incorrect operation - system did not function to specification (9)
- Interpretation of operation - no files lost, jobs ran ok (3)

12-16-75

PERFORMANCE

- ABILITY TO PROCESS FILES

  MSS Design Specification

  Provides, in Figure 12, detailed analysis of representative MSS activity.

  Ampex considers this a performance specification against which the final System can be tested.

- SYSTEM AVAILABILITY

  MSS Design Specification

  Section 11.5 guarantees System up-time in excess of 95%.

- DATA RELIABILITY

  ORACLE MSS System

  Proposal defines dependencies in Section 12.2 of accuracy on media reliability. This translates into the following set of requirements:

  WRITE (DESCEND)

  - Qualified Tape Only
  - Read Verify
  - Automatic Demark

  READ (ASCEND)

  - Reread
  - Extended Recovery Procedures

NOTE: All data reliability figures assume the above procedures have been followed. In any test where data reliability is to be measured, the test size must be at least 10 x the lowest common denominator in the rate. To measure rate of 1 error/ 2.5×10^9 bytes, at least 2.5×10^{10} bytes should be read during that period.

TGW
12/17/75

INTERPRETATION OF SPECIFIED ERROR RATES

- UNRECOVERABLE ERROR RATE

$$\text{RATE} = 5 \times 10^{-11} = \frac{1}{2 \times 10^{10}} = \frac{1}{8 \times 2.5 \times 10^{9}}$$

(1)

RATE = 1 ERROR OCCURRENCE/2.5 BILLION BYTES READ

- HARD ERRORS/DAY

$$\text{RATE} \approx (\text{ERROR RATE})\,(\text{TOTAL DATA TRANSFERRED PER DAY})$$

$$= (1/2.5 \times 10^{9})\ (5.2 \times 10^{9})^{(2)} \approx 2$$

RATE = 2 FAILURES/DAY

---

(1) RFP, Page 8 f).

(2) Table 12, MSS Design Spec.

TMS1 "TABLON" SYSTEM PERFORMANCE

REF. PROPOSAL 9-2

LEVEL A/B PERFORMANCE SUMMARY

Calendar:

Level A 3/22-4/29/72 (326 Hours)
Level B 10/31/12/8/72 (600 Hours)

926 Hours

Activity:	ACTUAL	SPECIFICATION	MARGIN
Bits Written:			
Multi-Blk	0.39×10^{12}		
Single-Blk	0.41×10^{12}		
Total	0.80×10^{12}		
Bits Read:			
Multi-Blk	2.89×10^{12}		
Single-Blk	1.92×10^{12}		
Total	4.81×10^{12}		
R/W Total	5.61×10^{12}	0.77×10^{12}	7.3
Bulk Updates-in-Place	55121		
Reread Rate (for error recovery)	0.4/1000 Blks	4.0/1000 Blks	10.0
*Unrecoverable Error Rate	1.5×10^{-11}	5×10^{-11}	3.3
Block Demark Rate:			
Tape Pretest	0.009%	1%	111
After Pretest	0.0045%		222
Tape Life (Reads to Block Failure)	3020	1200	2.5

SUMMARY OF PSAT HARDWARE EVENTS

	Occurrences
Descend Failures	26
Ascend Failures	1Ø
DAll Between SCP & EDCP	2
SAll & TDIF Interrupt Processing	8

TGW
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TMS-2 MASS STORAGE SYSTEM

ACTION ITEM 1 - OCTOBER REVIEW

- ISSUE:

  CONCURRENT ACCESS TO INDIVIDUAL TRANSPORT DRIVERS FROM BOTH STORAGE CONTROL PROCESSORS.

- AMPEX POSITION:

  NOT REQUIRED BY CONTRACT OR SPECIFICATION.

- RATIONALE:

  1. TRANSPORT DRIVER INTERFACE (TDIF) DESIGN ENABLES ONLY ONE TDIF TO BE IN CONTROL OF THE SCP/TD INTERCONNECT BUSS AT ANY GIVEN TIME.

  2. MSS DESIGN/SPECIFICATION CABLE DIAGRAM ON PAGE 172 INDICATES SINGLE CABLE.

  3. ARCHITECTURE CONFIRMED VIA "ORACLE MAINTENANCE AND DIAGNOSTICS" ON PAGE 150, PARAGRAPH 2.

WMS

12-15-75

TMS-2 MASS STORAGE SYSTEM

ACTION ITEM 2 - OCTOBER REVIEW

- ISSUE:

  MAXIMUM HARDWARE CONFIGURATION OF 6 TD'S, 64 TAPE TRANSPORTS, 3 DC'S, AND 6 EDCP'S DOES NOT HAVE "PERFECT SWITCHING" CAPABILITY.

- AMPEX POSITION:

  WILL PROVIDE "PERFECT SWITCHING" CAPABILITY WHEN AGENCY ORDERS MAXIMUM HARDWARE CONFIGURATION.

WMS
12-15-75

TMS-2 MASS STORAGE SYSTEM

ACTION ITEM 3 - OCTOBER REVIEW

- ISSUE:

  A STORAGE CONTROL PROCESSOR REQUIRES A DEDICATED DISK CONTROLLER TO ACCESS THE MASS STORAGE SYSTEM'S PRIVATE FILES.

- AMPEX POSITION:

  THE TMS-2 MSS CAN OPERATE WITH A SHARED BSS/MSS CONTROLLER. AMPEX RECOMMENDS A DEDICATED DISK CONTROLLER FOR PERFORMANCE CONSIDERATIONS.

- RATIONALE:

  1. DEDICATED DISK AND CONTROLLER INCLUDED IN ORIGINAL PROPOSAL PAGE 4-5 AND IN MSS DESIGN/SPEC PAGE 7-8.

  2. SYSTEM ARCHITECTURE IS SUCH THAT IN A TWO(2) CONTROLLER SYSTEM AS PROPOSED BY THE AGENCY WHEN BOTH EDCP'S ARE CONNECTED AND STAGING FILES, SCP CANNOT ACCESS PRIVATE DISKS FOR FILE REQUEST PROCESSING.

WMS

12-15-75

TMS-2 MASS STORAGE SYSTEM

ACTION ITEM 4 - OCTOBER REVIEW

- ISSUE:

  FUNCTIONS ARE NOT SPLIT AND/OR SHARED BETWEEN THE TWO(2) STORAGE CONTROL PROCESSORS.

- AMPEX POSITION:

  1. HIGH CONFIDENCE THAT SOFTWARE RESIDENT IN A SINGLE SCP WILL MEET SYSTEM PERFORMANCE NEEDS.
  2. PRIMARY REASON FOR SECOND SCP IS SYSTEM REDUNDANCY.
  3. AMPEX ERRED, SHOULD HAVE ADVISED AGENCY SOONER.

- RATIONALE:

  1. SCP NOT LIMITING ELEMENT IN SYSTEM PERFORMANCE.
  2. AMPEX "COST-TO-COMPLETE" ESTIMATE USED TO NEGOTIATE CEILING PRICE ASSUMED SINGLE SCP APPROACH.

WMS

12-15-75

2 MASS STORAGE SYSTEM

S/W SYSTEM FOR SINGLE SCP

- 1975 Software Development Based On This Concept.

- Performance

  Spec'd Performance Can Be Met Or Exceeded With This Concept. Both For Present and Expanded Configuration. Ampex Confidence -- Very High!!

  Performance Limits:
  1 DSS (Searches)
  2 Private Disk (Seeks)
  3 SCP Core Memory
  4 SCP Cycles

  Also, Host Overhead, Etc.

- Advantages

  - Overall System More Reliable (Less Active Hardware)
  - MTTR Improved (A/B Tests, Spares Considerations)
  - In Case Of Computer Failure: No Degradation
  - "Watch Dog" Program In Second CPU Supplied
  - Second CPU Can Be Backup For EDCP (Purchase TDIF)
  - This Type System Will Be Supported For General Market

12-16-75

IMS-2 DELIVERY SCHEDULE

COMPLETION PLANNING

- RWC PSAT CONFIDENCE TEST

  ONE(1) DAY - MID-JANUARY 1976

- INTERNAL SOFTWARE DESIGN IMPLEMENTATION REVIEW

  12-30 JANUARY 1976

- FINAL RELEASE SOFTWARE SCHEDULE
  - UPDATED MANPOWER PLAN
  - UPDATED FUNCTIONS LIST
  - AGENCY REVIEW MID-FEBRUARY 1976

- SUNNYVALE PSAT PLANNING
  - AGENCY TEST DEFINITION, ACCEPTANCE CRITERIA, PROCEDURE MID-FEBRUARY 1976.
  - AMPEX INTERNAL TEST MINIMUM THIRTY(30) DAYS.
  - AGENCY TEST TARGET SCHEDULE MAY 1976.

12-16-75

TMS-2 MASS STORAGE SYSTEM

PREREQUISITES FOR PSAT - SUMMARY

- Prior Agreement On Definition Of All Tests To Be Run.

- Prior Agreement On What Is A Discrete Test Session And What Are The Acceptance Criteria Of That Test.

- Prior Agreement On Test Procedure, Sequence Of Tests, What To Do In Case Of Difficulty Or Failure.

12-16-75

TMS-2 MASS STORAGE SYSTEM

PSAT TEST DEFINITION

DETAILED GROUND RULES

- THE AGENCY 20 JOB STREAM TEST IS A GOOD TEST (ASSUMING THE JCL ERRORS ARE CORRECTED, ASSUMING THE CONTROL STATEMENT ERRORS ARE CORRECTED, AND ASSUMING THERE IS A RESTART PROCEDURE). HOWEVER, IT RUNS TOO LONG TO FULLY PRETEST IT BY THE END OF JANUARY AND IT IS NOT RERUNABLE.

- AMPEX EDITED VERSION OF THE AGENCY 20 JOB STREAM TEST IS JUST AS MEANINGFUL AS THE FULL TEST FROM A FUNCTIONAL STANDPOINT. THE DATA SET SIZES AND FORMATS ARE IDENTICAL. THE ONLY DIFFERENCE IS THAT ONLY 1/10 OF EACH DATA SET IS FORMATTED AND COMPARED BY THE 370/155. THE FULL DATA SET IS ALWAYS ASCENDED AND DESCENDED.

- AMPEX WOULD ALSO ACCEPT ANY OTHER SPECIAL TESTS THE AGENCY WOULD LIKE TO RUN IF:

  1. ALL SUCH TESTS ARE INDEPENDENT OF ANY OTHERS AND RUN AFTER THE 20 BASIC JOB STREAMS.

  2. NO SINGLE SPECIAL TEST RUNS LONGER THAN ONE HOUR.

12-16-75

S-2 MASS STORAGE SYSTEM

PSAT TEST SESSIONS AND ACCEPTANCE CRITERIA
DETAILED GROUND RULES

- A TEST SESSION IS NOT A CHUNK OF TIME. A TEST SESSION IS A SEQUENCE OF SPECIFIC TEST PROCEDURES, E.G., RUN JOB STREAMS 5, 6, AND 7.

- PASS/FAIL ACCEPTANCE CRITERIA SHOULD BE ON A TEST BY TEST BASIS NOT ON A TEST SESSION.

- ASCEND/DESCEND FAILURES SHOULD BE COUNTED AND SCORED SEPARATELY.

  - DESCEND FAILURES CAUSED BY 3330/3830 CONTROLLER RETRIES INVOLVE FINAL RELEASE ERROR RECOVERY. AS A TEMPORARY MEASURE, AMPEX MUST BE PERMITTED TO ALLOCATE A DUMMY DATA SET OVER SUCH CYLINDERS.

  - ASCEND FAILURES OF READ VERIFIED FILES ARE HARD ERRORS AND SHOULD BE COUNTED AS SUCH. HOWEVER, TO PERMIT CONTINUED TESTING, MANUAL ERROR RECOVERY SHOULD BE PERMITTED.

12-16-75

T.3-2 MASS STORAGE SYSTEM

PSAT TEST PROCEDURES

DETAILED GROUND RULES

- THE CONTRACT REQUIRES THAT DETAILED TEST PROCEDURES ARE AGREED TO BEFORE ANY TEST. THIS SHOULD AT LEAST INCLUDE AGREEMENT ABOUT WHAT JOB STREAMS WILL BE RUN DURING A TEST SESSION.

- FAILURES ARE LIKELY TO OCCUR. EVEN IN A FULLY PRODUCTION SYSTEM WHEN FAILURES OCCUR INFREQUENTLY, THERE ARE AGREED UPON RECOVERY PROCEDURES. AMPEX MUST BE PERMITTED TO DO WHATEVER IS NECESSARY TO RECOVER FROM A FAILURE. AMPEX MAY OPT TO RERUN AN ENTIRE TEST OR INDIVIDUAL SECTIONS NECESSARY TO RECOVER.

- BLACK BOX SURPRISE TESTS OR TEST PROCEDURES (BIGGIE 1,2,3,4) ARE NOT PERMITTED UNTIL AFTER ALL MAINSTREAM TESTING IS DONE.

12-16-75

AMPEX Software Management

AMPEX relies on two types of working papers to track progress and to plan future tasks of the mass storage software effort. Copies of these papers are submitted to the Agency each month. This type of reporting came about because AMPEX would not have to do any extra paper work, the Agency said it would be satisfied with looking at AMPEX actual working documents. The first report is called the Software Manpower Plan, it shows time in weeks, and each individual programmer and his schedule of tasks to accomplish. Some tasks show a break out of time devoted to subtasks (such as design, code, debug and testing) while many tasks have no breakout. The Plan has proved to be very confusing in that task names are arbitrarily changed from month to month, tasks disappear with no indication as to why, tasks are always being rescheduled, and at this late date the Plan has never shown a complete lists of all tasks needed by the system.

The second report is entitled, "External Function List/Schedule". It contains a summary list of all the system functions and the date when each function is to be completed. We have found by observation that the term complete for this report means that the function has been designed, coded, and debugged at a unit level. Effort required to integrate the function with the rest of the system and test is not specifically shown anywhere. Our problem with this report is that only end dates are shown, there is no way of telling when work begins on a function and how it is progressing.

A further complication is that the two reports are not complementary. There is no sure way to look at tasks shown on the Software Manpower Plan and relate them to the External Function List or vice versa. We found in October that AMPEX had reported several Functions as complete when they were not. I feel this error was due to their confusion rather than a deliberate attempt to mislead us.

Considering that these reports represent the primary tools used by the AMPEX managers, it is easy to see why they continue to misjudge their progress and have such a difficult time in estimating future events. For purpose of illustration some of the major tasks are excerpted to show AMPEX performance and scheduling.

TASK NAME	DATE OF REPORT	TASK SCHEDULE	MAN WEEKS
BSS Failure	June	2 Aug - 5 Sept	8
	July	1 Sept - 3 Oct	8
	Sept	4 Nov - 2 Jan	8
	Oct	2 Jan - 1 Mar	8

(This task seems to be continually put off)

DSS Failure	June	1 Oct - 1 Dec	9
	July	4 Oct - 4 Dec	9
	Sept	3 Jan - 3 Mar	9
	Oct	3 Jan - 2 May	18

(This task continually delayed and then time doubled)

3330 Development	June	1 May - 4 May	7
	July	1 May - 4 July	16
	Sept	1 May - 3 Sept	23
	Oct	2 Mar - 2 Mar	1

(This task originally scheduled 7 weeks finally took 24).